Analysis of Technology Teachers' Meta-Congitive Awareness in Federal Capital Territory, Abuja.

Owodunni, Samuel A.

Abstract

The study was designed to examine the metacognitive awareness of technology teachers in the Federal capital Territory, Abuja. It further looked at the nature and concept of metacognition, measure the perception of technical college technology teachers metacognitive processes and identify their metacognitive activities as it relates to teaching and learning. The study was a survey research design. The sample size was 121 participants comprised 70 urban technology teachers (46 males and 24 females) and 51 rural technology teachers (32 males and 19 females) selected from the population through stratified and simple random techniques. The researcher constructed separate inventory for the measurement of metacognitive awareness of teachers. The inventory was validated with the help of experts, for use in Nigeria culture. The reliability coefficient computed for the instrument was found to be 0.88 using Cronbach's Alpha formula. Percentage, Mean, standard deviation and t-test statistics were used for the analysis. The study revealed that teacher factors such as gender, teaching experience, academic qualification can influence metacognition. Similarly, the study revealed that male technology teachers and urban technology teachers achieved higher scores in Metacogitive Awareness Inventory (MAI) sub scales, knowledge cognition and regulation cognition. There was significance difference between the mean scores of male and female technology teachers, between urban and rural technology teachers in the MAI sub scales. Based on the findings of the study, it was recommended that the training programmes of technology teachers among others should focus on Self motivation, Self awareness about intellectual strengths and weaknesses, awareness about learners' expectations and training.

Key Words: Cronbach's Alpha Formula, *Technology Teachers, Metacognitive Awareness, Metacognitive Awareness Inventory*

Introduction

Metacognitive awareness of the teaching process is developmentally beneficial to induce commitment and increase the understanding of the thinking process in students. This can have enormous practical value to teachers in order to formatively assess self learning strategies and select the most appropriate strategy. It is easily apparent that no one has better access to study educational settings and students than teachers themselves. Yet that rarely happens. Ultimately, metacognitive awareness is essential for teachers in taking responsibility for teaching and achieving the core competency of being a critical thinker (Ur-Rehman, 2011).

With developments in communication technologies, exponential growth in knowledge and need for advanced intellectual abilities to productively function in the modern world, it is imperative that we rediscover the traditional values of education such as good moral, honesty, generosity and fortitude, de-value power over others and learning from personal experience where experience plays a vital role in learning and design teaching and learning experiences that model and facilitate thinking process in students. The question arises whether teachers' training institutes takes cognizance of this concept.

Teacher education offers a variety of classroom methods and techniques (problem-solving technique, constructivist strategy, inquiry method, collaborative method etc) to trainee teachers, but not make certain teachers to understand when, why, and how to use them (Ur-Rehman, 2011). Consequently, teachers remain dormant, which resulted into serious problems in classroom communication. Hence, teachers are not always successful in setting lesson objectives, activities, and engaging students. Consequently, teachers need to think carefully about what they present during a lesson and how they provide students with

important information (Child, 1995). Research studies indicated that teachers who are aware of their own metacognitive functioning tend to play a more significant role in helping learners develop skills in metacognition (Daley, 2002 cited in Ur-Rehman, 2011). Similarly, different researches also indicate that learners who are aware of their thinking are more strategic and perform better than those who are unaware (Rivers, 2001). While there are several approaches to metacognitive instruction, the most effective, involve providing the learner with both knowledge of cognitive processes and strategies (to be used as metacognitive knowledge), and practice in using both cognitive and metacognitive strategies and evaluating the outcomes of their efforts (Livingston, 1996).

Metacognition has been defined as "thinking about thinking" and is a complex form of higher-order thinking (Ur-Rehman, 2011). Metacognition involves the ability to think about own cognitions, and to know how to analyze, to draw conclusions, to learn from, and to put into practice what has been learnt (King, 1999). Metacognition was originally referred to as the knowledge about and regulation of one's cognitive activities. Under this inclusive definition, a series of metacognitive terms have been presented through the years. These included: metacognitive beliefs, metacognitive awareness, metacognitive experiences, metacognitive knowledge, feeling of knowing, judgment of learning, theory of mind, metamemory, metacognitive skills, executive skills, higher-order skills, metacomponents, comprehension monitoring, metalearning, learning strategies, heuristic strategies, and self-regulation. Indeed, there are far too many terms commonly associated with metacognition, leaving the whole area somewhat confused (King, 1999).

Flavell (1979) expanded the concept of 'metacognition' to include (i) metacognitive knowledge and (ii) regulation of cognition.

Metacognitive knowledge is "knowledge about what factors act and interact in what ways to affect the course and outcome of cognitive enterprises" (Flavell, 1999, p.4). The major categories of these factors are person, task and strategy. The person category encompasses everything that a person believes about his nature and nature of other people as cognitive processors. It refers to the type of acquired knowledge and beliefs that concern human beings as cognitive organisms.

Regulation of cognition refers to select processes that coordinate cognition. De Corte, Verschaffel and Eynde in Ur-Rehman (2011) argue that self-regulation comprises effective learning and problem solving. It is the ability to use metacognitive knowledge strategically to achieve cognitive goals. Regulation of cognition is essential to the development of students' ability to learn cognitive strategies, and extend the application of these strategies and gain control over them.

Metacognition has a number of concrete effects on learning. It plays an important role in oral comprehension, reading comprehension, problem solving, attention, memory, social cognition, personality development, communication and various types of self-control and self-instruction which are key concerns for school (Flavell, 1979). It can be ascertained that metacognition helps students do better and as such teachers should be able to develop the skills in students. An extensive body of knowledge found relationship between metacognition and performance on test of intelligence. Research literature on metacognition indicated that much work has been done on students. However, research on teachers' metacognition has been a neglected area. Due to its importance, this research study has been conducted to analyse technology teacher's metacogitive awareness as it relate to teaching and learning in technical colleges. The study was unique in a sense that findings of the study would be helpful for teacher

educators. Thus, the present study has undertaken the task of analysing technology teachers' metacognition awareness using Schraw and Dennison (1994) Metacognitive Inventory (MAI). The inventory has been adapted for local use. Some teacher related factors such as academic and professional qualification, teaching experience and in-service training were also taken into account.

The main goal of teaching is to train students with information and tools that allow them to solve problems objectively. Students often try to solve a problem without thinking. Thus, many students were unable to solve non-school problems even when they have the essential knowledge and tools necessary to do so. This deficiency can be linked to absent or ineffective metacognitive awareness. This situation demands to enrich teaching profession by inducting metacognitively oriented teaching strategies (Hartman, 2001). Metacognitive teaching means that teachers think about their own thinking regarding teaching goals, teaching strategies, sequence of lesson, teaching materials, students' characteristics and needs, and other issues related to course, instruction and assessment before, during and after lessons (Hartman, 2001). But many technology teachers are not aware of the importance of metacognitive and metacognitive skills therefore, they find it difficult to induct the students metacognitively. Teaching metacognitively can improve classroom communication and facilitate academic performance. Metacognitive teaching not only benefits students, but also increases the teacher's own learning and motivation. It enables awareness and control over how teachers think about their teaching (Medway, 1991). This study was designed to analyze metacognitive awareness of technology teachers in Federal Capital Territory (FCT), Abuja.

Purpose of the Study

The objectives of the study were to:

1. Measure the awareness of Technology teachers about metacognitive process by identifying metacognitive activities (such as planning, management strategies and evaluation) of Technology teachers.
2. Find out the differences in metacognitive activities of male and female Technology teachers.
3. Find out impact of personal factors on metacognitive awareness of Technology Teachers.

Hypotheses

1. There is no significant difference between Metacognitive awareness of male and female technology teachers.
2. There is no significant difference between the metacognitive awareness of urban and rural technology teachers.

Methodology

This study was a survey design in which metacognitive awareness of technology teachers were assessed using metacognitive inventory. Impact of teacher related factors like gender, academic qualification, inservice training, computer training, teaching experience and internet use were also considered. The population of the study was 302 Technology Teachers in Public Senior Secondary Schools, Federal Science Technical College and Government Science Technical School, Garki in FCT. To get the sample size, stratified sampling technique was used to stratify population into rural and urban teachers, while simple random technique was used to select 40% of the teachers for the study. The choice of 40% sample is in agreement with the statement of Ball and Gall in Uzoagulu (1998) that when a defined population is less than a thousand, 40% or more could be used for reduction of sampling error. Thus, a sample size of 121 which comprised 70 urban technology teachers (46 males and 24 females) and 51 rural technology teachers (32 males and 19 females) were selected

randomly for the study.

Researcher adapted Schraw & Dennison (1994) metacognitive awareness inventory (MAI) for measuring the metacognitive awareness of teachers, because it is claimed to be a reliable and valid instrument (r = 0.89). The inventory was validated with the help of experts for use in Nigeria culture. The inventory was also factor analyzed. For adoption to be socially and culturally suitable, valid and reliable inventory, several efforts were carried out such as:

i. A number of empirical studies on metacognition were reviewed.
ii. Use of expert opinion about items of instruments.
iii. Use of statistical analysis to determine the validity and reliability of the instruments.

The inventory represents two factors of metacognition, i.e. knowledge of cognition and regulation of cognition. Knowledge of cognition or metacognitive knowledge refers to knowledge about self and about learning strategies as well as knowledge about when, why and how to use these strategies.

Within the knowledge component were statements of declarative knowledge (knowledge about self and strategies), procedural knowledge (knowledge about strategy use), and conditional knowledge (when and why to use strategies). The regulation of cognition refers to the control aspect of learning such as planning (goal setting), management strategies (organizing), comprehension monitoring, debugging and evaluation (analysis of performance and strategy effectiveness). The original inventory consisted of 52 items which were group into 6 components as planning, management strategies, evaluation, procedural,

conditional and declarative knowledge. The items to these subscales were based on the Schraw and Dennison inventory, with the addition of a few new statements. The procedural knowledge consisted of 4 items, declarative knowledge containing 6 items, and conditional knowledge having 4 items, planning subscale included 5 items, management strategies having 11 items and evaluation subscale having 7 items. Each inventory was a four point scale ranging from "Always" to "Not at all" in which the participants were asked to tick appropriate box. The responses were coded as: Always = 4; Sometimes = 3; Undecided = 2; Not at all = 1

The inventory was validated by five experienced researchers and minor changes in wording and grammatical structures were incorporated. The instrument was administered on sample of 30 technology teachers (20 males and 10 females) in Government Technical College Mopa Kogi State to determine its reliability. The reliability coefficient of the instrument was found to be 0.88 using Cronbach's Alpha formula.

The researcher administered the instrument in the selected schools with the help of four research assistants. Before giving instruments, a brief introduction about the research was provided to the respondents. One hundred and twenty one (121) copies of the instrument were administered on the respondents. The entire 121 copies administered were retrieved and analyzed. Average completion time for the metacognitive inventory was ten minutes respectively. Mean, percentage, standard deviation and t-test were used to analyse the data obtained on metacognitive awareness of technology teachers. Hypotheses were tested at .05 alpha level

using SPSS version 13.0.

Results

Table 1: Academic qualification and teaching experience of

Gender	Academic Qualification			Teaching experience		
	Bachelor	Master	PhD	11-20years	11-20years	>20years
Male	69	7	1	14	21	42
Female	42	2	0	09	14	21
Total	**111**	**09**	**1**	**23**	**35**	**63**

Table 1 suggests that a greater number of technology teachers possessed bachelor degree certificates, 9 had master degree while only 1 male teacher possessed PhD degree. The table also shows that sample of teachers consisted of experienced teachers, with 63(53%) having more than 20 years teaching experience.

Table 2: percentage rating of technology teachers on in service and computer training information

Gender	In-service Training				Computer training			
	No	%	Yes	%	No	%	Yes	%
Male	67	87	10	13	56	72.7	21	27.3
Female	39	88.3	0	11.7	31	69.8	13	30.2
Total	**106**	**87.5**	**1**	**12.5**	**87**	**71.7**	**34**	**28.3**

Table 2 revealed that majority of technology teachers has not received any in-service training (87.5%) or computer training (71.7%).

Table 3: percentage rating of technology teachers on the use of Internet facilities

Gender	Internet usage					
	Not at all	%	Sometimes	%	Always	%
Male	58	75.3	16	20.8	03	3.9
Female	36	81.4	07	16.3	01	2.3
Total	94	77.5	23	19.2	04	3.3

The data presented in Table 3 revealed that 77.5% of technology teachers have not been making use of internet facilities at all, 19.2% use it occasionally and 3.3% of the technology teachers make use of internet facilities frequently. The inability of majority of technology teachers to make use of internet facilities may be due to lack of internet facilities in many secondary schools and the low proportion using the Internet on a regular basis reflects this.

Table 4: mean scores of technology teachers on metacognitive awareness inventory (MAI) Sub scales.

Metacognitive Inventory (MAI) Sub scales	Academic Qualifications		Teaching Experience		Inservice Training		Computer training		Internet usage	
	Bachelor degree N= 911	Higher degree N= 10	<20 years N=58	>20 years N=63	No N=106	Yes N=15	No N=87	Yes N=34	Not use N=94	Use N=27
	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$
Procedural knowledge	13.4	24.8	15	23	16	19	18	22.1	10	25
Declarative knowledge	21	23.4	17	20	13	18	24	25.6	13.1	20.8
Conditional knowledge	09	13.4	20	22	14	16	18	19.6	16.5	28.5
Planning	27	38.8	24	39	27	36	26	21.5	25	37
Management strategies	36	49	40.5	48.3	35	45	41	48	34	42
Evaluation	21	27.6	23.1	28.2	39	48	29	39.6	22	32

Key: N = number of respondents; $\bar{X}$ = Mean

The data presented in Table 4 showed that technology teachers that possessed higher qualifications, teaching experience above 20 years, involved in in-service and computer training and can make use of internet facilities had higher mean scores in all sub scales of the MAI inventory. This indicated that teacher factor such as academic qualification, teaching experience, inservice training computer training and internet usage can influence metacognition of technology teachers.

Table 5: t-test Analysis of the mean scores of technology teachers by gender and location on of metacognitive awareness inventory Sub scales.

Metacognitive Inventory (MAI) Sub scales	Gender					Location				
	Male Teachers N = 77		Female Teachers N = 44		Statistics	Urban Teachers N = 70		Rural Teachers N = 51		Statistics
	$\bar{X}$	SD	$\bar{X}$	SD	t-test p	$\bar{X}$	SD	$\bar{X}$	SD	t-test p
Procedural knowledge	16.4	1.64	17.8	1.62	0.76 n.s	18	2.02	17.1	1.58	2.20 p<0.05
Declarative knowledge	46	1.87	43	3.06	0.37 n.s	24	2.89	25.6	2.99	2.31 p<0.05
Conditional knowledge	13	2.03	13.4	2.05	1.60 n.s	18	2.00	16.6	2.15	1.70 n.s
Planning	27	1.98	24.5	2.84	0.48 n.s	26	2.29	21.5	2.77	0.45 n.s
Management strategies	14	4.97	15	4.40	0.75 n.s	43	4.99	42	4.50	0.88 n.s
Evaluation	22	3.89	27.6	4.70	2.90 p<0.05	30	3.89	33.6	5.01	0.66 n.s

Key: N = number of respondents; $\bar{X}$ = Mean ; SD = Standard Deviation; ns = not significant

The data presented in Table 5 showed that male teachers possessed high mean score on Declarative knowledge and planning sub scales of the inventory. However, the difference was significant only in the case of evaluation sub scale. The table also reveals that urban teachers possessed high mean score on all sub scales except evaluation sub scale of the inventory. However a significant difference was noticed in the procedural and declarative knowledge only.

Table 6: t-test Analysis of the mean scores of technology teachers by gender and location on Knowledge and Regulation Cognition.

Items	Gender						Location					
	Male N 77			Female N 44			Urban N 70			Rural N 51		
	$\bar{X}$	SD	t-test	$\bar{X}$	SD	t-test	$\bar{X}$	SD	t-test	$\bar{X}$	SD	t-test
Knowledge of Cognition	59.8	4.9	0.99	60.2	4.8	ns	62.0	5.0	2.19	61.6	5.6	p<0.02
Regulation of cognition	94.5	4.8	1.29	91.4	7.7	ns	89.9	7.8	0.43	91.3	98.4	ns
MAI Score	155.2	14.2	1.32	150.7	13.0	ns	154.17	13.20	1.02	153.2	16	ns

Key: N = number of respondents; $\bar{X}$ = Mean; SD = Standard Deviation; ns = not significant

Table 6 revealed that male teachers have higher mean score than female on knowledge of cognition and regulation of cognition and there was no significant difference between mean scores of male and female teachers in MAI. The table also presents a picture of mean score of technology teachers of urban and rural localities in MAI. In every case, the urban teachers performed better, however, the difference was not statistically significant except on knowledge of recognition.

Table 7: Testing of Hypotheses

Hypotheses	Statement	t-test	P	Results
Hypothesis 1:	There is no significant difference between Metacognitive awareness of male and female technology teachers	t = 1.27	Not signif	Null hypothesis accepted, there was no significant difference between MAI score of male and female technology teachers.
Hypothesis 2:	There is no significant difference between the metacognitive awareness of urban and rural technology teachers.	t = 1.20	Not signif	Null hypothesis accepted, there was no significant difference between MAI score of urban and rural techno logy teachers

Discussion of Findings

The finding of this study revealed that teacher factors such as gender, location, academic qualification, teaching experience, in-service and computer training and internet usage can enhance metacognitive ability of technology teachers. This is in line with findings of Ur-Rehman (2011) who carried out a study on Assessment of science teachers' meta-congitive awareness and its impact on the performance of students in Parkistan, and discovered that, gender, location, academic qualification, teaching experience, inservice and computer training and internet usage can enhance metacognition of science teachers. The study indicated that there was no significant difference between metacognition awareness of male and female technology teachers. Thus, the present study revealed little significant gender differences in metacognitive awareness. The lack of gender difference with the teachers is indicating that the level of awareness of metacognition by both male and female teachers is the same. Similarly, no significant difference was found in metacognitive awareness of urban and rural technology teachers. This finding is in consonance with the finding of Ur-Rehman (2011) who found out that there is no significant difference between metacognition awareness of male and female science teachers. Others variables that are related to metacognitive awareness included internet use and computer training. The most important teacher characteristics which related to performance were those which could be described as the characteristics of 'good' teachers. This raises a fascinating question: how can we develop 'good' teachers? Are these people simply born that way? Do the skills develop with experience (as the study here suggests)? The key question is the extent to which such skills can be enhanced in any way by means of training or support. The evidence is not encouraging. Studies indicated that there is dearth of trained teachers for e-learning, lack of facilities, infrastructures and equipment (Mac-Ikemenjima, 2005; and Jegede & Owolabi,

2008), although the latter study showed clearly that it was influenced by inability of teachers to control the situation which serve as hindrance and progress. Thus, there was no suggestion that the in service support was inadequate or that teachers were in any way unwilling to develop. The system seemed to make it impossible for such development to occur easily (Mac-Ikemenjima, 2005; Jegede & Owolabi, 2008). The findings of the study also supported the claim of previous research that teaching experience of teachers is positively correlated with metacognition. This in line with the opinion of Thomas, Kane, Jonah, Rockoff, Douglas and Staiger (2011) who suggests that experience and thinking ability results in teacher performance

Conclusions

The analyses showed clearly that metacognition is not a single variable and is a highly complex collation of many aspects of awareness related to the whole process of teaching and learning. This means that future research is much needed to tease out the complexities of the notion of metacognition. While academic qualification did not make any significant impact in the MAI score of technology teachers, experience, better computer training and Internet surfing enhanced metacognition of technology teachers.

Recommendations

The following were the main recommendations of the study:

1. The study revealed that technology teachers need support and training on metacognitive awareness which includes Self motivation, Self awareness about intellectual strengths and weaknesses, Awareness about learners' expectations, Analyzing usefulness of teaching strategies, Help in thinking strategies, Memory training and organizing time, Learning strategies, Computer training, Setting teaching/learning goals and summarizing lessons.
2. The findings of the study also suggested that internet

surfing have good impact on metacognitive awareness. Therefore, the teachers are encouraged to be using it. For this purpose, computer with Internet connectivity should provided to all schools.

References

Child, D. (1995). Psychology and the teacher. (5th-ed). New York: Holt, Rinehart & Winston.

Flavell, J. H, Miller, P. H., & Miller, S. A. (1993). Cognitive development.(3rd ed). Englewood cliffs, NJ: Prentice hall.

Flavell, J. H.(1987). Assumptions on the concept of metacognition and on the evelopment of metacognition. In F. Weinert & R. Kluwe (Eds) Metacognition, Motivation and Understanding. Hillsdale, NY: Erlbaum.

Hartman, H. E. (2001). Metacognition in learning and instruction: Theory, research and practice. Netherland: Kluwer Academic.

Jegede, P.O. & Owolabi, A.J. (2003). Computer education in Nigerian secondary schools: Gaps between policy and practice. *Meridian: A Middle School Technology Journal*, 6(2) 1 11. Retrieved from http://www.ncsu.edu/meridian/sum2003/nigeria/nigeria .pdf.

King, K. (1999). Metacognition in the composition classroom. Idaho State University. Idaho:

Livingston, J.A. (1996). Effects of metacognitive instruction on strategy use of college students. Unpublished manuscript, State university of New York). Buffalo:

Mac-Ikemenjima, D. (2005, April). E-Education in Nigeria: Challenges and prospects. A Paper presented at the 8th UN ICT Task Force Meeting. Dublin, Ireland.

Rivers, W. (2001). Autonomy at all costs: an ethnography of metacognitive self assessment and self management among experienced language learners. In Modern Language Journal 85,No 2.USA:

Schraw, G. & Dennison, R. (1994). Assessing metacognitive awareness. Contemporary Educational Psychology.19(4)(pp460-475)

Thomas, J. Kane, Jonah, E. Rockoff, Douglas, O. Staiger, F. (2011). **What effect does experience have on teacher effectiveness?** National Bureau of Economic Research Retrieved on 25 June, 2013 from http://winginstitute.org /Graphs/Staff/What-effect-does-experience-have-on-teacher-effectiveness/

Ur-Rehman, F. (2011). Assessment of Science Teachers Meta-Congitive Awareness and its impact on the performance of students. PhD thesis, Allama Iqbal Open University, Islamabad.

Uzoagulu, A. E. (1998). Practical guide to Writing Research Project Report in Tertiary Institutions. Enugu: John Jacob's Classic Publishers Ltd.

Author
Owodunni A. Samuel, Department of Industrial and Technology Education, Federal University of Technology, Minna. E-mail: owoscosam@yahoo.com